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(54) **Lance**

(57) A lance comprises a metal tube (1) having a sleeve of a refractory material (shown by chain — dotted lines) mounted substantially co-axially therewith, the sleeve being retained upon the tube by means of two sets of anchoring means (3, 4) extending into the body of the refractory material, one set of anchoring means (3) being fixedly attached to the tube and the other set of anchoring means (4) being capable of axial movement relative to the tube. Preferably, the two sets of anchoring means are mounted upon different axial portions of the tube with the fixedly mounted set being located at the outlet end of the tube, i.e. that end of the tube which is to be inserted into the molten metal during use, the relatively moveable set being mounted on the tube over the remainder of its length.

Fig.1

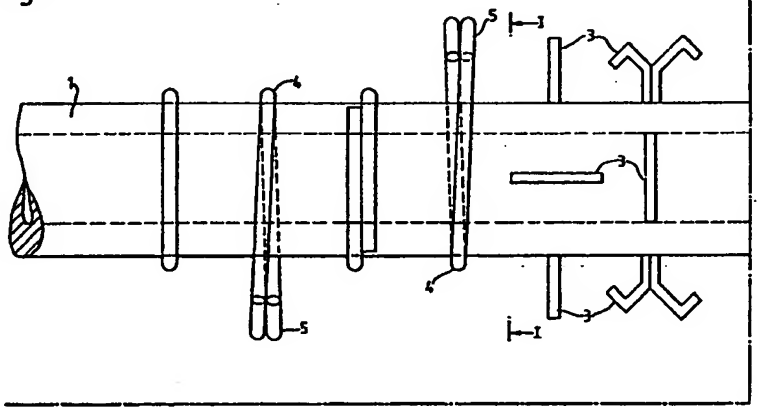
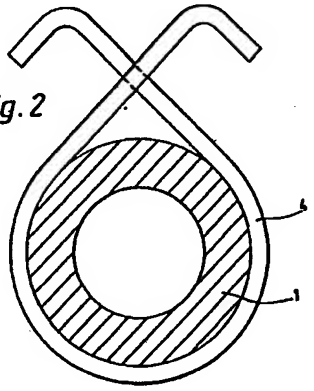


Fig. 2



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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

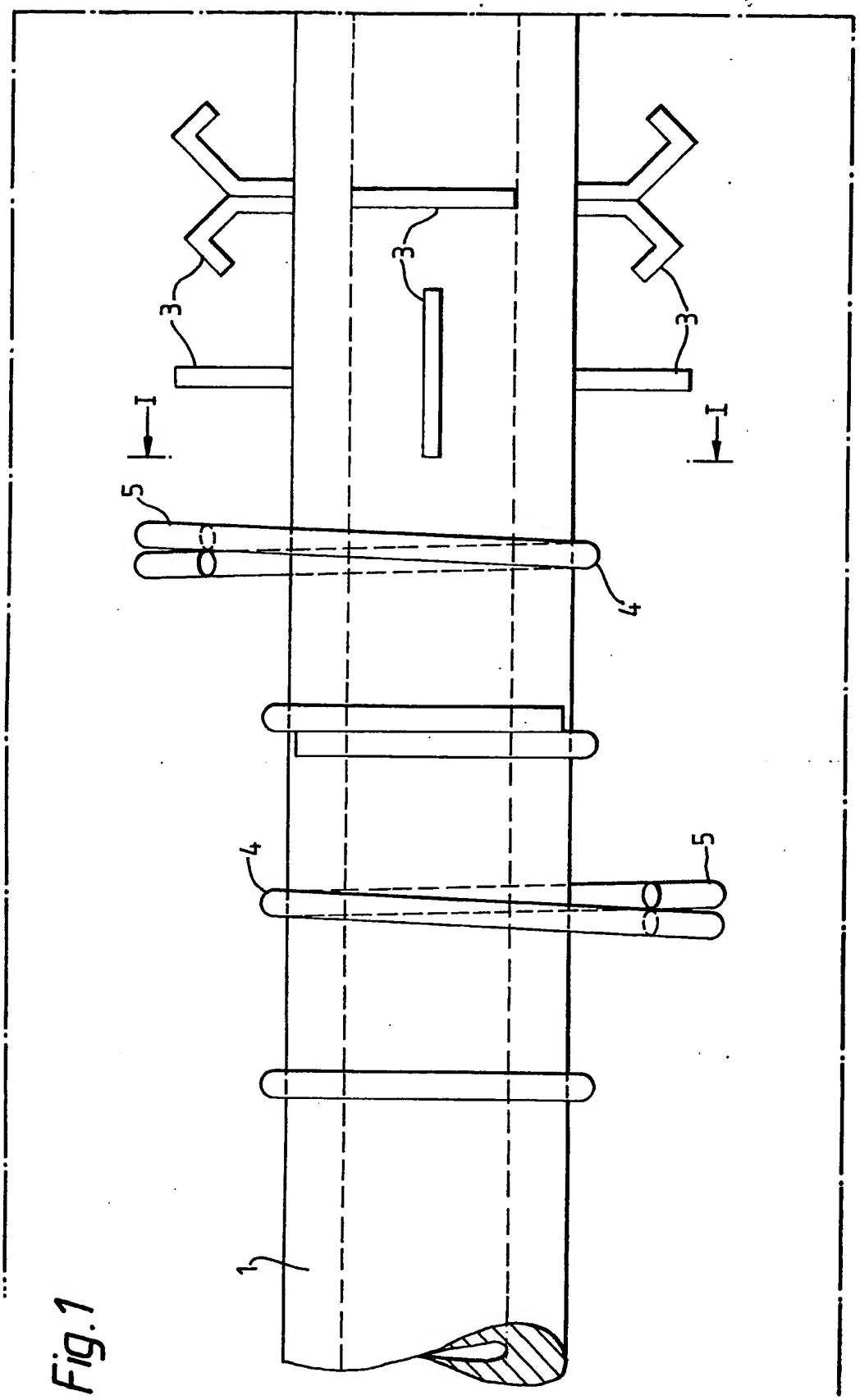


Fig.1

Fig. 2

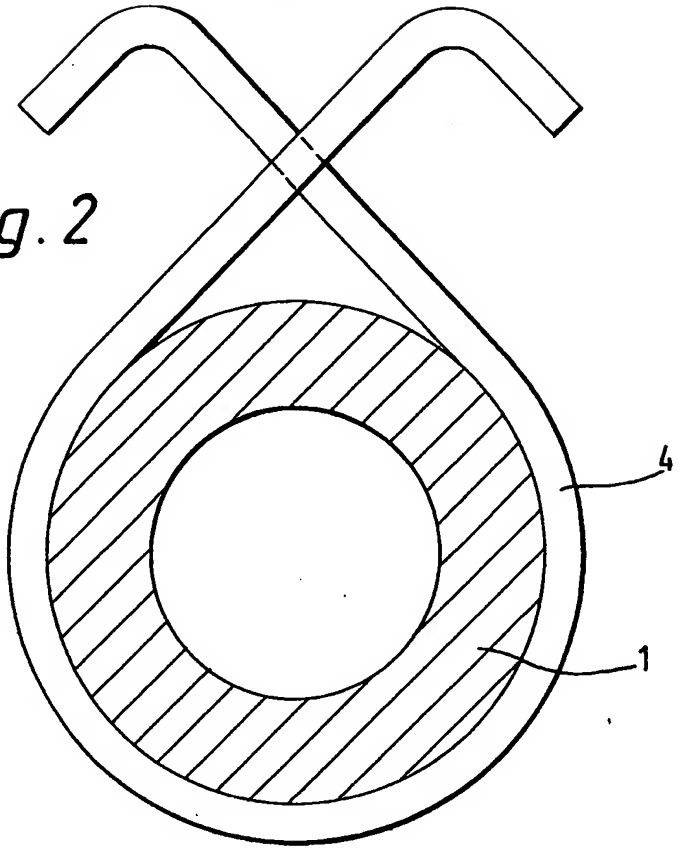
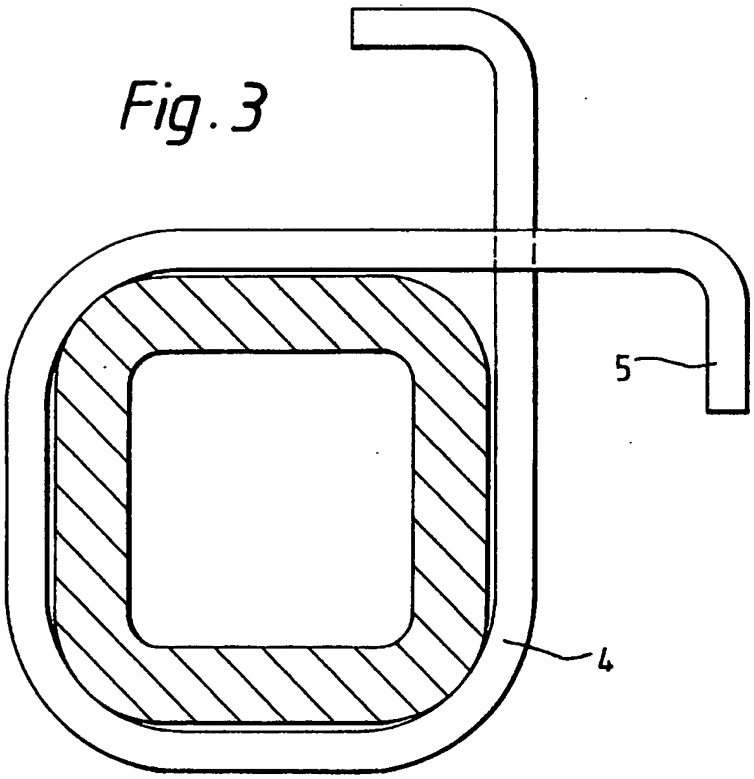


Fig. 3



SPECIFICATION

Lance

The present invention relates to lances used to inject gases or powdered solids into molten metals, notably into molten iron or steel.

During the production of many metals, it is desired to inject a gas or a powdered solid into the molten metal. This is conventionally achieved by means of a hollow tube whose end is inserted into the molten metal. For convenience, the term lance is used herein to denote such tubes. Such lances are usually constructed from a steel tube, protected from the molten metal by a refractory sleeve which surrounds the steel tube. However, problems are encountered with such lances since cracks frequently develop in the refractory sleeve, causing premature failure of the lance.

In making lances, the refractory sleeve is fixed to the steel tube by means of a series of anchors which are fixed to the tube, e.g. by being welded thereto. The anchors are embedded in the refractory material, e.g. as it is cast around the tube, and provide a rigid linkage between the sleeve and the tube. However, we have found that the use of such anchors is a major cause of cracking of the refractory sleeve and we have devised a form of anchoring means which reduces this problem.

Accordingly, the present invention provides a lance which comprises a metal tube having a sleeve of a refractory material mounted substantially co-axially therewith, the sleeve being retained upon the tube by means of two sets of anchoring means extending into the body of the refractory material, one set of anchoring means being fixedly attached to the tube and the other set of anchoring means being capable of axial movement relative to the tube.

Preferably, the two sets of anchoring means are mounted upon different axial portions of the tube with the fixedly mounted set being located at the outlet end of the tube, i.e. that end of the tube which is to be inserted into the molten metal during use, and the relatively moveable set being mounted on the tube over the remainder of its length.

The tube can be of any desired cross-section, e.g. square, rectangular, circular or eliptical. If desired, tubes of a circular or eliptical cross-section can be supported and strengthened along part or all of their length, for example by locating them inside another close-fitting tube of a square or rectangular cross-section, or by welding an axial length of angle iron or other supporting element to the tube. The anchoring means and the refractory sleeve encompass the strengthening elements where present.

The anchoring means which are fixedly mounted on the tube can be of any suitable shape, e.g. T, L or hook shaped and can be bolted, welded or otherwise fixed to the tube. Preferably, this set of anchoring means is located at the outlet end of the tube and extend over the terminal 1 to 25% of the length of the tube at axial intervals of from 5 to 50, notably 10 to 20 cms.

Preferably, the anchoring means capable of axial movement with respect to the tube are in the form of coil springs having integral members extending outwardly from the tube in a generally radial direction. The coil(s) of the spring are a close fit on the tube so that they grip the tube and are thus located upon the tube. Desirably, the springs are single loop springs formed from a spring material, e.g. spring steel. The radially extending members are conveniently located at, or are provided by, the free ends of the spring coil. In addition to acting as anchorage points for the sleeve, they can serve the secondary function of acting as levers to assist in splaying the turns of the coil and thus enable the springs to be moved freely into position along the length of the tube. As indicated above, the springs are mounted over the majority, e.g. 99 to 75%, of the length of the tube extending from the inlet end of the tube and preferably at axial intervals of from 5 to 50 cms, notably 10 to 20 cms.

The sleeve can be made from a wide range of refractory materials and is preferably cast *in situ* around the tube during manufacture. The sleeve for example is from 10 to 30 cms thick and conveniently is of the same general cross-section as the tube around which it is formed.

In a preferred embodiment of the invention, a sleeve of insulating material is provided between the tube and the refractory sleeve, either as a sleeve of material extending continuously along the length of the tube or as a series of shorter sleeves extending between the anchoring means. The insulating material can, for example, be formed from ceramic fibres in a bonding matrix. Alternatively, cardboard or other combustible material sleeves can be provided between the refractory sleeve and the tube. During use of the lance, the cardboard or other material will burn away to form an air gap between the refractory sleeve and the tube.

A preferred form of the lance of the invention will now be described by way of illustration with respect to the accompanying drawings in which:

Figure 1 is a side view of the lance;

Figure 2 is an enlarged cross-section of the lance of Figure 1 on the line 1—1; and

Figure 3 is a cross-section of a lance using a square section tube.

A lance comprises a steel tube 1 enclosed in a refractory sleeve 2 (shown by broken lines). Welded to tube 1 at its outlet end is a series of eight hook shaped members 3 located in pairs displaced circumferentially by 90° from one another. Located over the remaining length of the tube 1 are a number of single coil steel springs 4. These springs are orientated upon the tube so that the radially extending free ends 5 on a spring are displaced by 90° circumferentially from the free ends on the adjacent springs. The springs 4 are mounted on tube 1 at axial intervals of approximately 15 cms along the length of the tube, although only four such springs are shown in the drawing.

Springs 4 are mounted upon tube 1 by pressing the free ends 5 of the spring together, thereby increasing the diameter of the ring part of the spring and permitting it to be slipped onto tube 1 and moved freely into position. On releasing the free ends 5, the spring firmly grips the tube.

When the springs 5 are in position, the tube is positioned in a cylindrical box shaped mould and a refractory material is cast around the tube using conventional materials and techniques. Preferably, the mould is vibrated during casting.

The casting forms a refractory sleeve around the tube 1 in which members 3 and 5 are embedded and act as reinforcement for the sleeve as well as holding the sleeve in position on the tube. Members 3 are fixed and retain sleeve 2 in position on the tube. Springs 4 on the other hand can move axially and can accommodate relative movement between the sleeve and the tube which can occur during setting of the refractory material during casting or during use of the lance.

CLAIMS

1. A lance which comprises a metal tube (1) having a sleeve (2) of a refractory material mounted substantially co-axially therewith, the sleeve (2) being retained upon the tube (1) by means of two sets of anchoring means (3), (4) extending into the body of the refractory material, one set of anchoring means (3) being fixedly attached to the tube (1) and the other set (4) of anchoring means being capable of axial movement relative to the tube (1).

2. A lance as claimed in claim 1 wherein the two sets of anchoring means (3), (4) are mounted upon different axial portions of the tube (1), the fixedly mounted set (3) being located in the portion adjacent the outlet of the tube (1), the moveable set (4) being located in the remaining length of the tube (1).

3. A lance as claimed in either of claims 1 or 2 wherein the moveable anchoring means (4) comprise coil springs substantially co-axially mounted on the tube and having members (5) extending radially outward from the tube (1).

4. A lance as claimed in any of the preceding claims wherein an insulating sleeve is provided between the refractory sleeve (2) and the tube (1).

5. A lance as claimed in claim 4 wherein a sleeve of combustible material is provided which is capable of being burnt away during use of the lance to form an air gap between the refractory sleeve (2) and the tube (1).

6. A lance which comprises a steel tube (1) having mounted substantially co-axially thereon a sleeve (2) of a refractory material, the sleeve (2) being retained upon the tube (1) by means of two sets of anchoring means (3), (4) extending radially outwardly from the tube (1) and embedded in the refractory sleeve (2), one set being provided by members (3) fixedly attached to the tube (1) over the terminal 1 to 25% of the length of the tube (1) adjacent the outlet of the tube, the other set (4) being provided by single coil springs substantially co-axially mounted on the tube (1) within the remaining length of the tube and capable of relative movement axially upon the tube, the coils (4) having members (5) integral therewith which extend radially into the refractory sleeve (2).

7. A method for producing a lance a claimed in claim 1 which method comprises mounting the relatively moveable set of anchoring means (4) upon a tube (1) provided with the fixed anchoring means (3); and casting a refractory material around the tube (1) to form the refractory sleeve (2).

8. A tube for use in the method of claim 7 which comprises a tubular member (1) having fixedly mounted thereon over the terminal 1 to 25% of the length thereof from the outlet of the tubular member anchoring means comprising members (3) extending radially outward from the tubular member (1); in association with members comprising coil springs (4) adapted to be mounted substantially co-axially upon the tubular member (1) and having members (5) extending radially from the coil spring (4).

9. A lance as claimed in claim 1 substantially as hereinbefore described.

10. A lance substantially as hereinbefore described with respect to and as shown in the accompanying drawings.

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